



Armed Forces College of Medicine AFCM



Functions of self-mediated immunity& Self MHC molecules (part 1)

Dr.Alaa Ahmed Aly
**Professor of Microbiology &
Immunology**

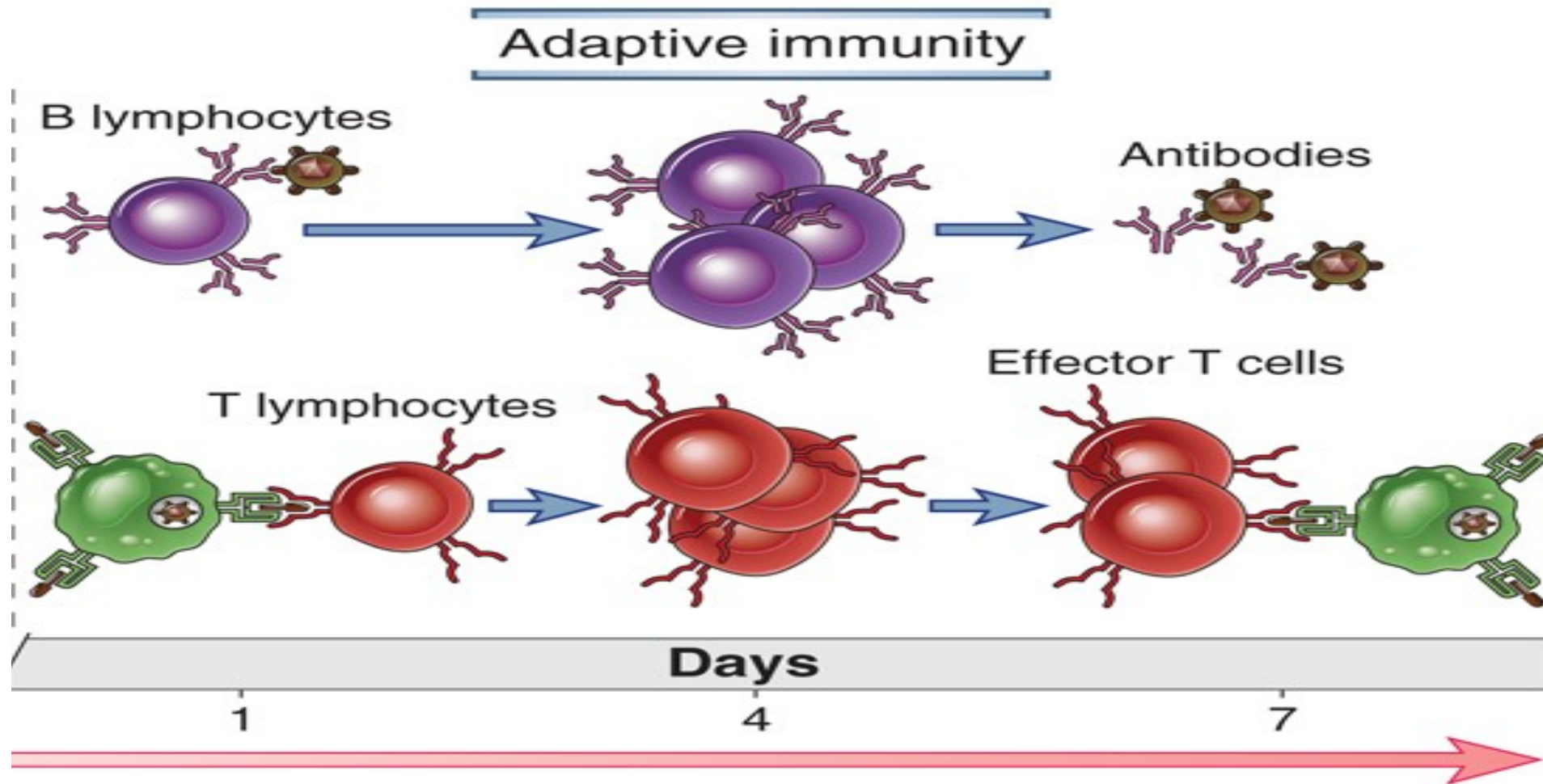
ILOs of Immunogens, Antigens & Self molecule



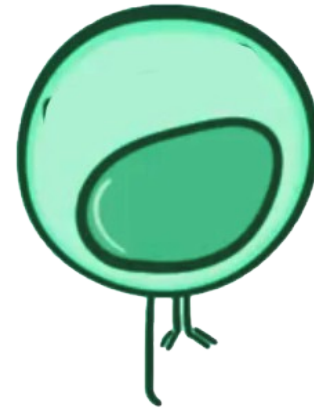
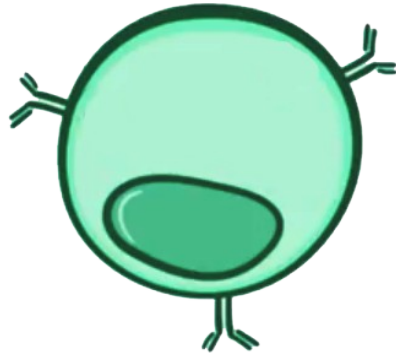
By the end of this lecture the student will be able to:

1. Outline series of reactions and functions of cell mediated immunity
2. Compare between MHC class I and II regarding structure , function and importance in health
3. Discuss steps of development of T lymphocytes in thymus.

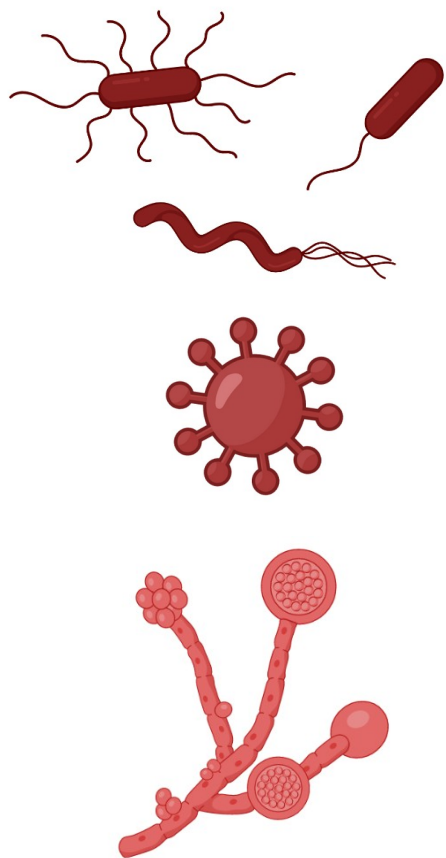
Types & Functions of adaptive immunity



Types & Functions of adaptive immunity

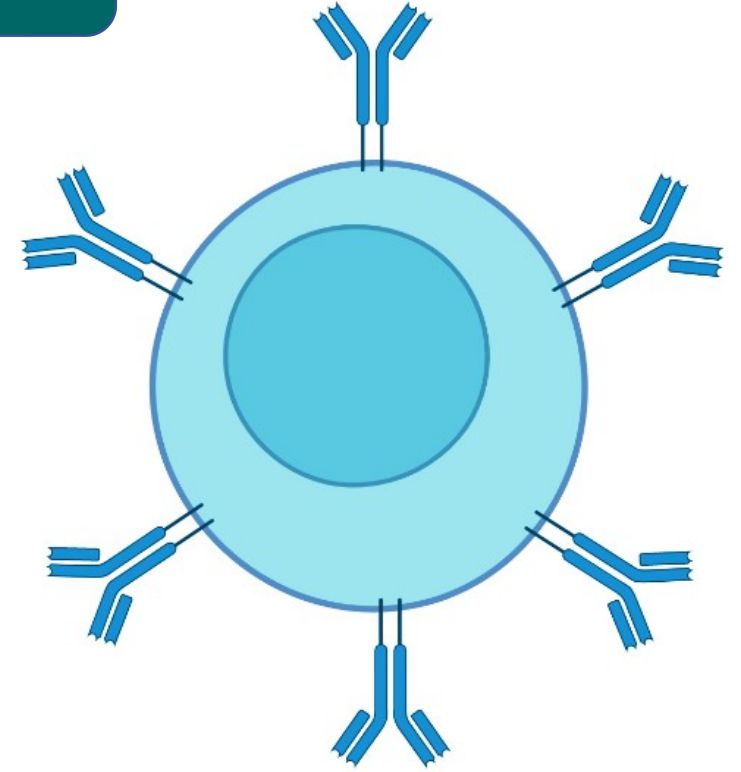
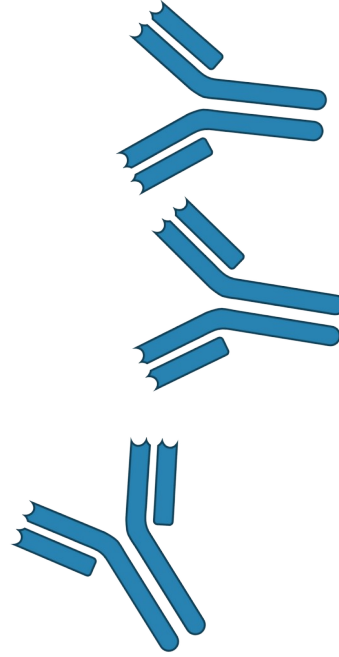
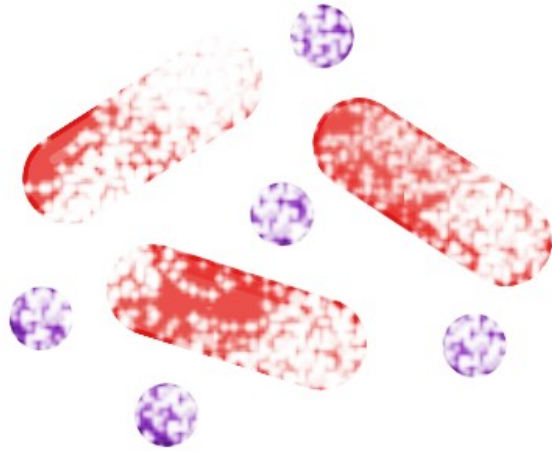


T helper
T cytotoxic قاتلة



Body fluids

Humoral Immunity



خارج
الخلية

Functions of Humoral immunity

ازالة

Elimination of extracellular microbes & their toxins

- Mediated by Abs produced by activated B cells (plasma cells)

Functions of Cell mediated immunity

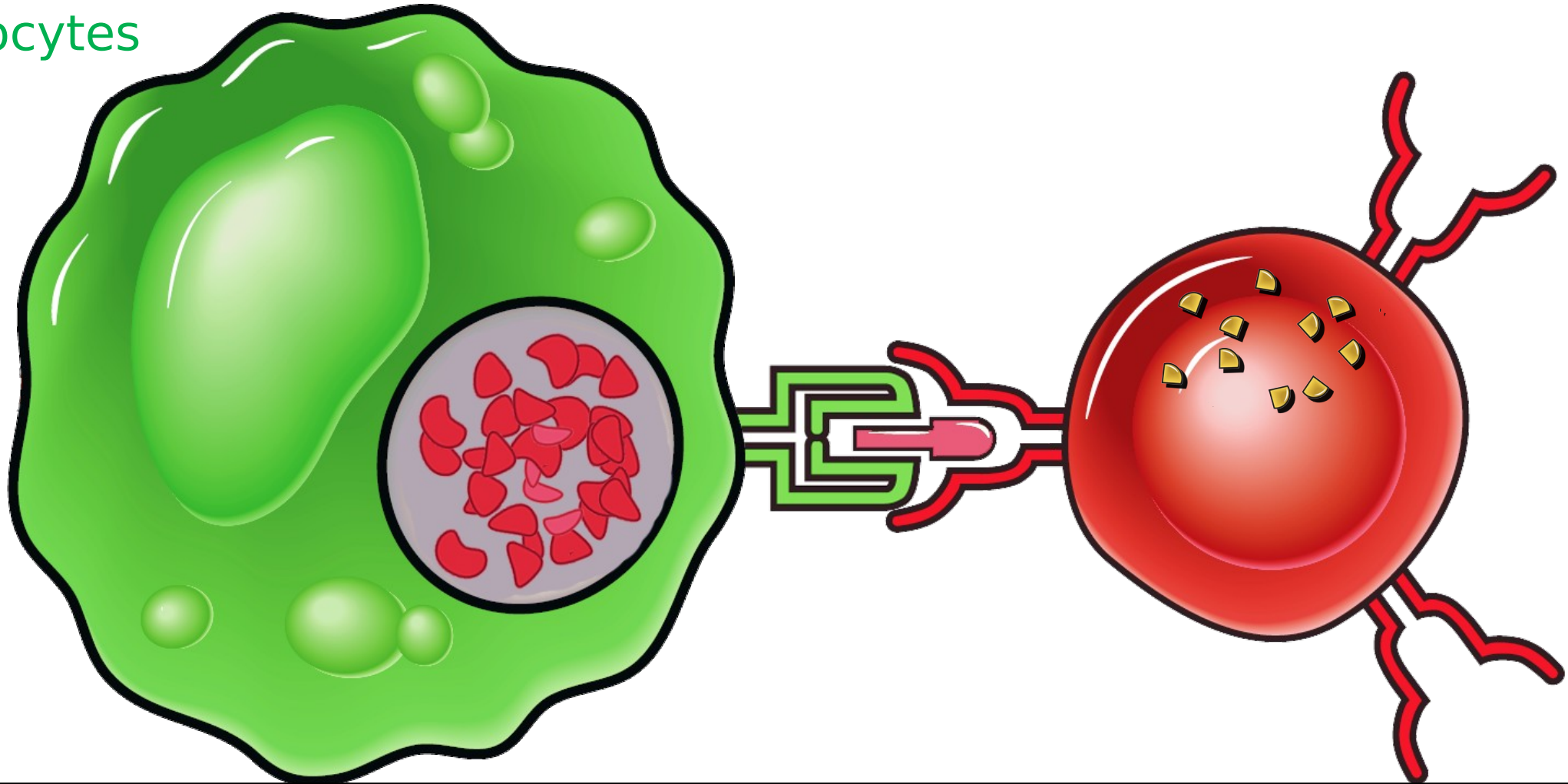
By activated T cells

المستوطنة داخل
الخلايا

A) Elimination of Intra Cellular (IC) microbes

A) Elimination of intra cellular (IC) microbes

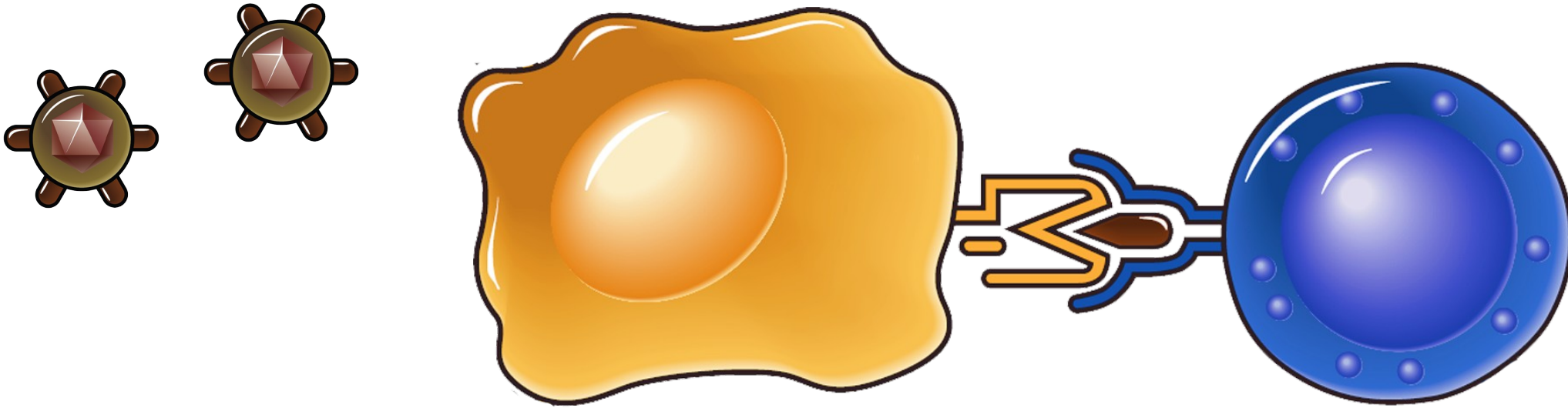
Phagocytes



1) Few bacteria as *Mycobacterium tuberculosis* (M. TB)

Survive & replicate in phagocytes → Phagocytes must be activated by Interferon γ from T helper

A) Elimination of IC microbes

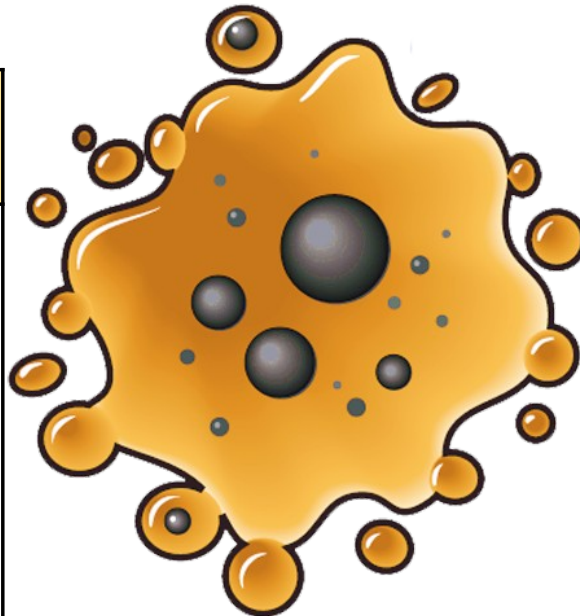


2) Viruses (obligate intracellular organisms)

Survive & replicate in
non-phagocytic cells
(tissue cells)



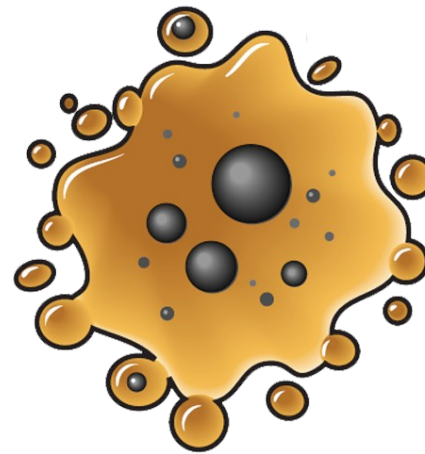
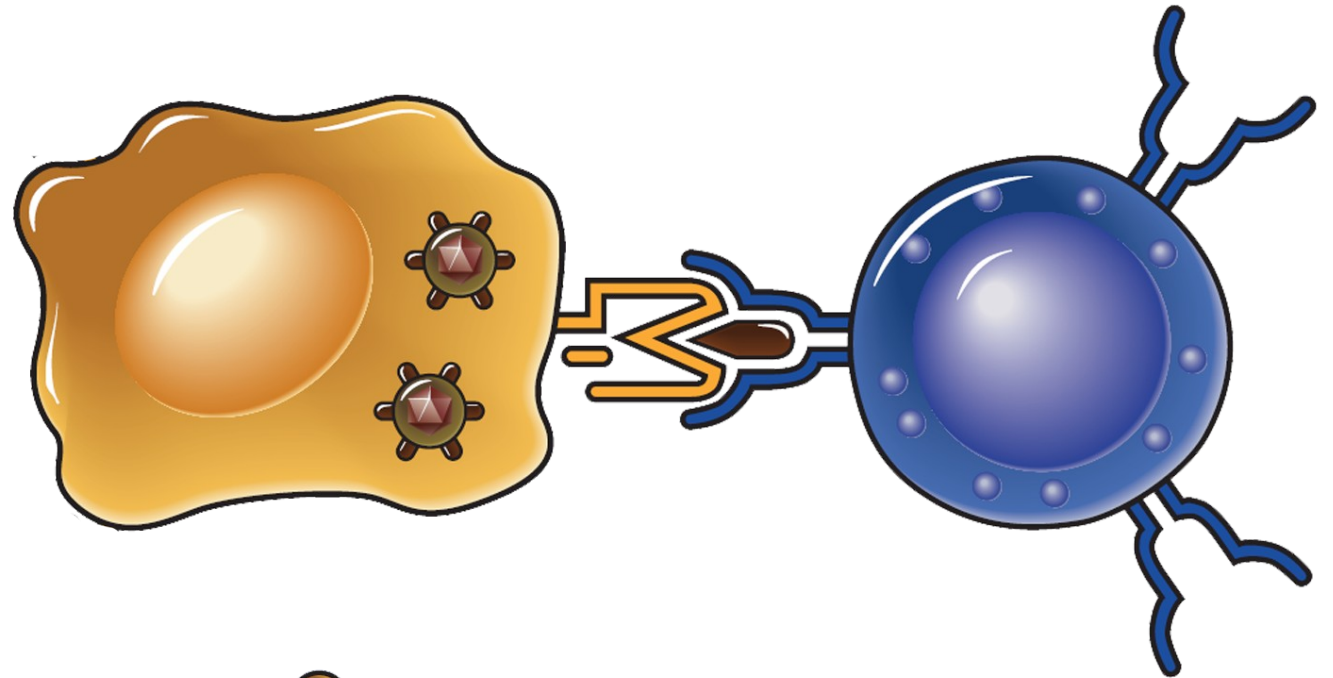
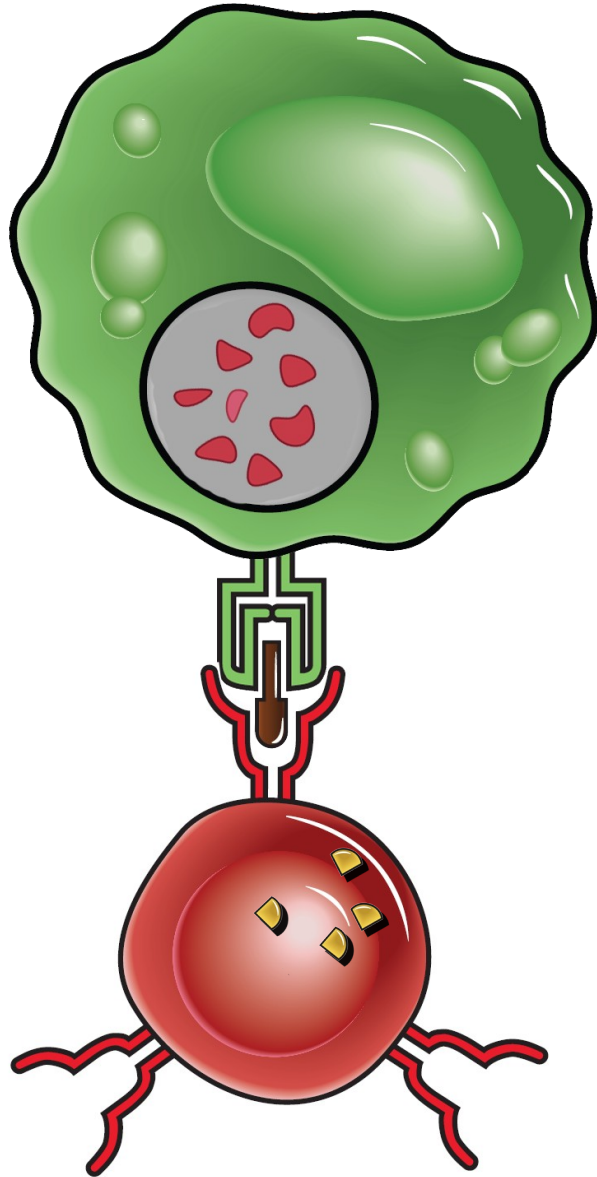
These cells must be killed by
Cytotoxic T lymphocytes (CTLs)



Cytotoxic T lymphocytes

Cell mediated Immunity

A) Elimination of IC microbes



EPITOPE (Antigenic determinant)

Antigen (Ag)

A substance recognized by cells of immune system

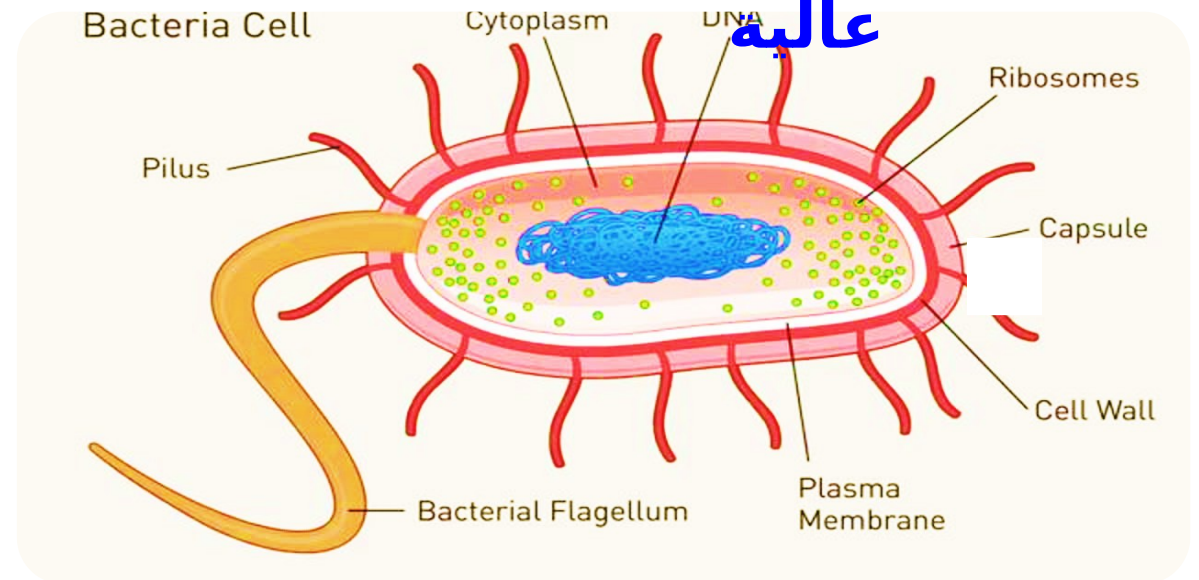
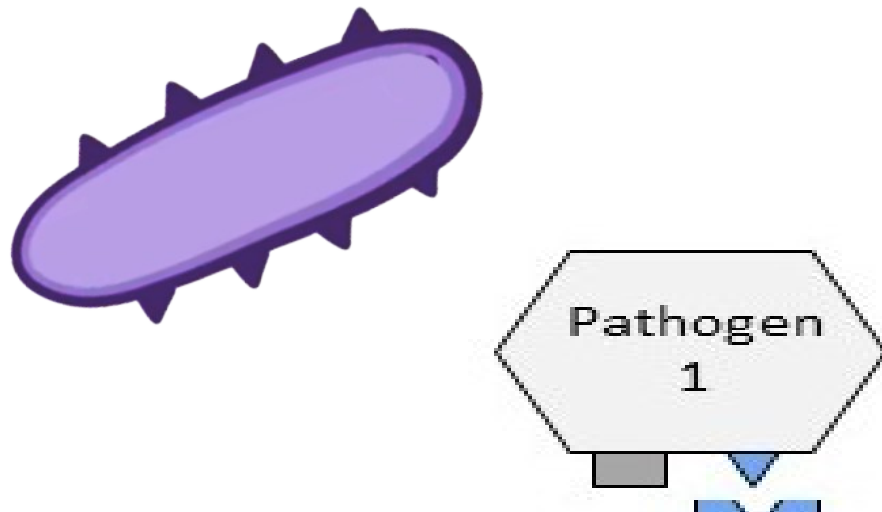
e.g components of bacteria

The 3 Ags will be recognized by the **same B & T lymphocyte ?**

No

Adaptive immunity is highly specific

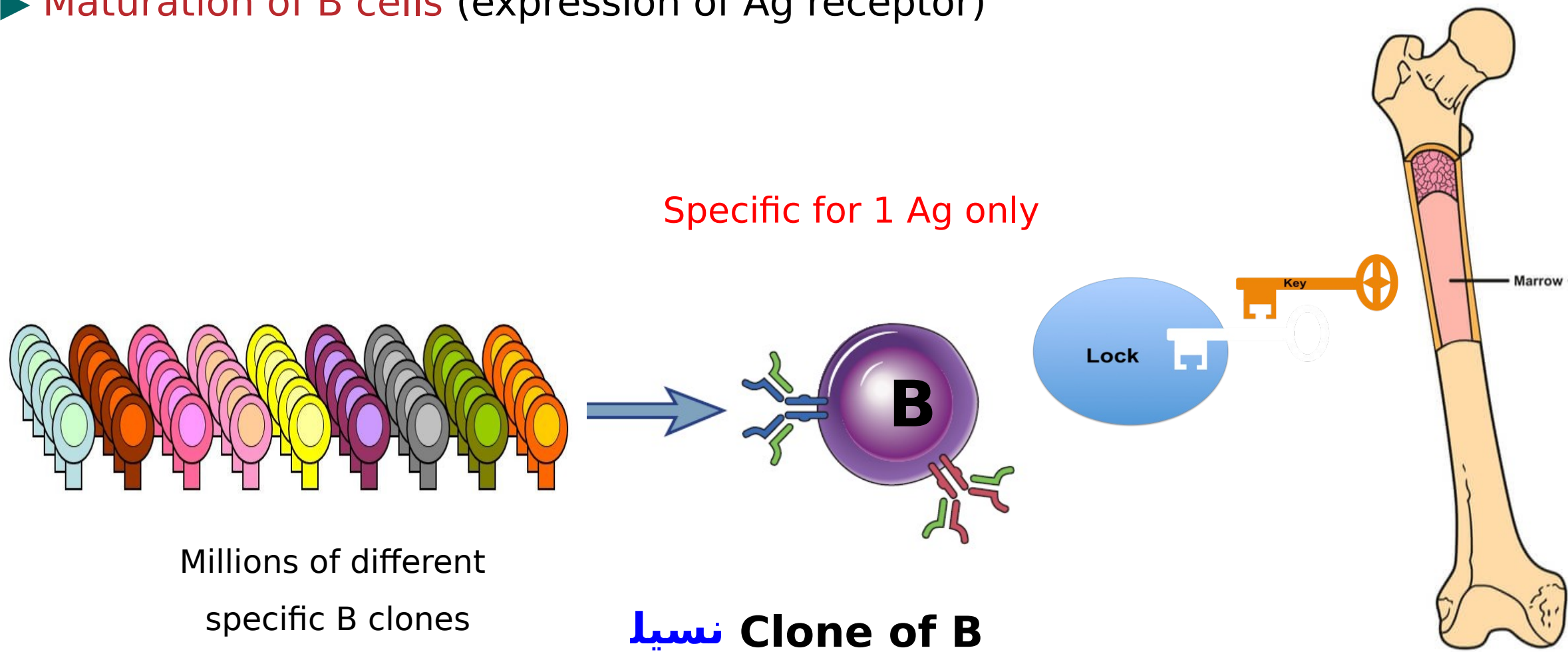
خصوصية
عالية



EPITOPE (Antigenic determinant)

A) Bone marrow

► **Maturation of B cells** (expression of Ag receptor)



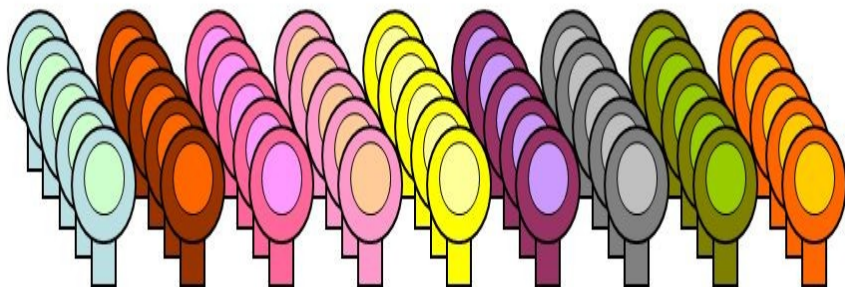
Organs of the immune system

I) 1ry (Central) Lymphoid Organs

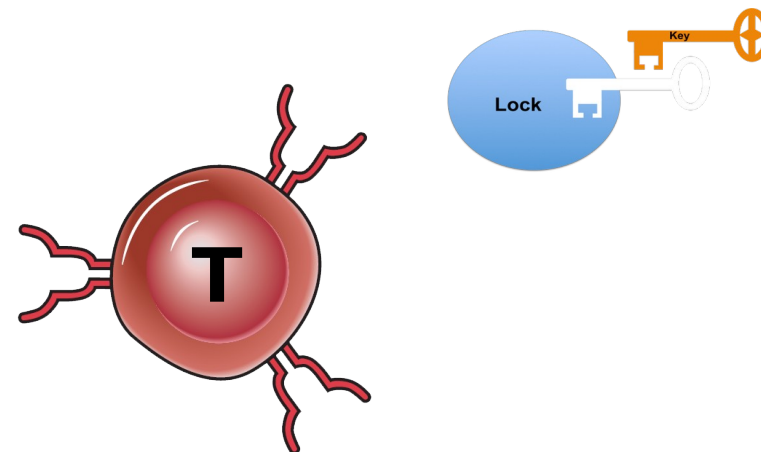
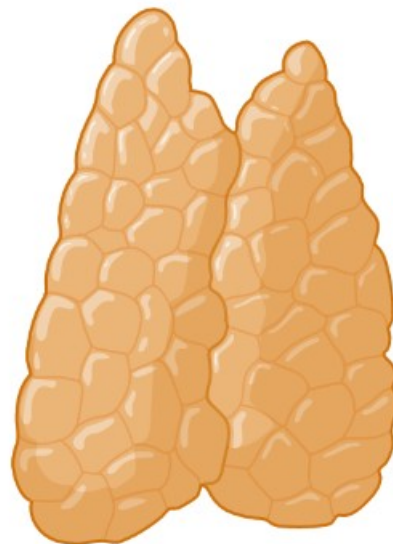
B) Thymus

Maturation of T lymphocytes (expression of Ag receptor)

Specific for 1 Ag only



Millions of different
specific T clones



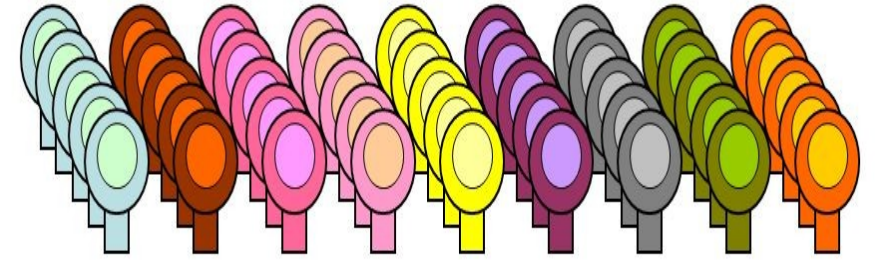
**Clone of T
cell**

Comparison between innate & adaptive immunity

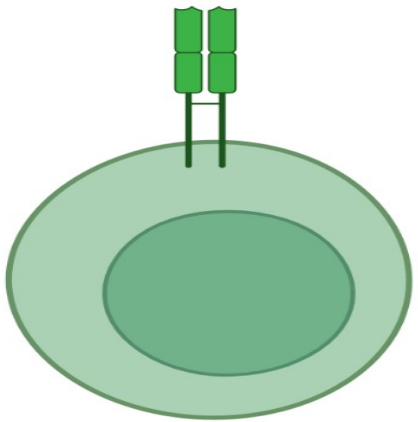
Adaptive (Acquired) immunity

Each B & T cell clone has a **unique receptor** reacting only with **its specific Ag (Epitope)**

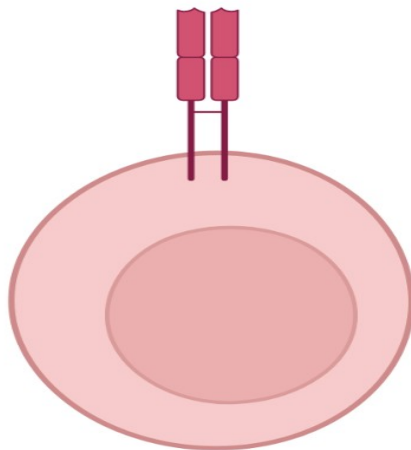
خصوصية
Specificity



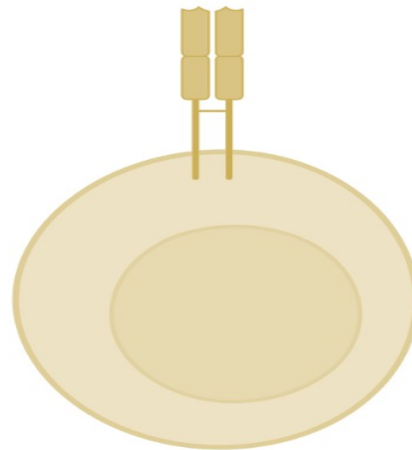
Millions of different
specific clones



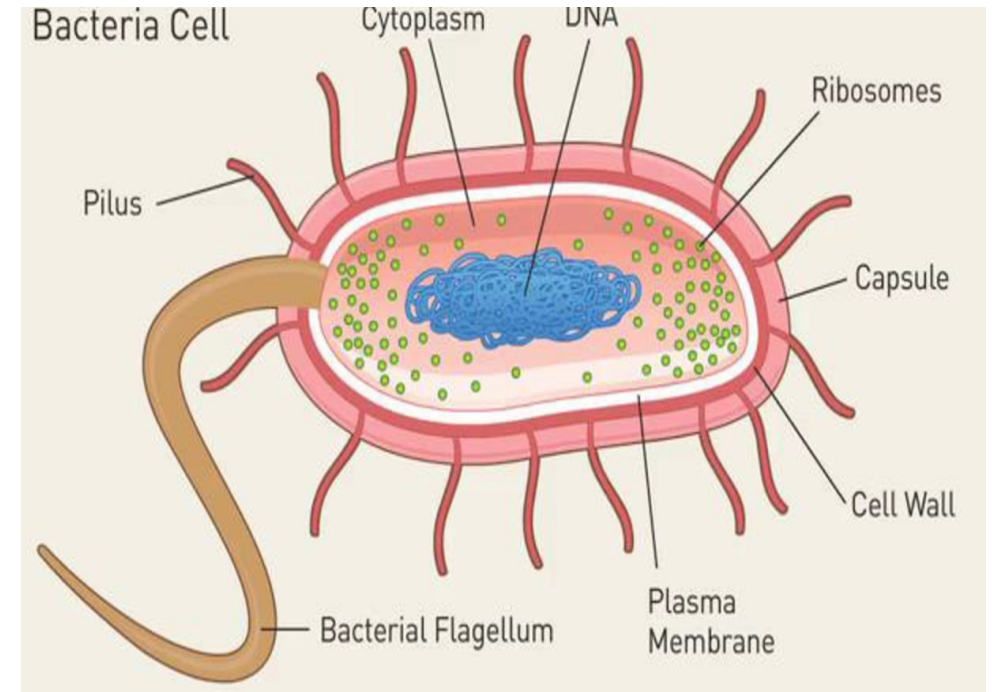
Clone 1



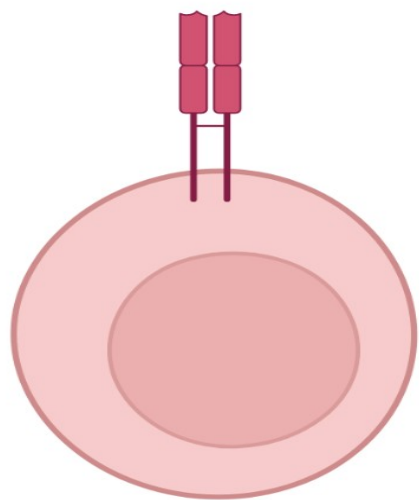
Clone 2



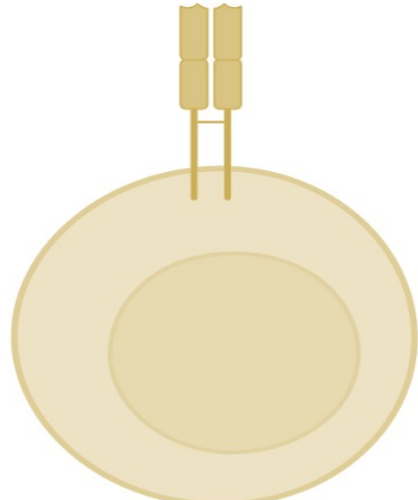
Clone
3



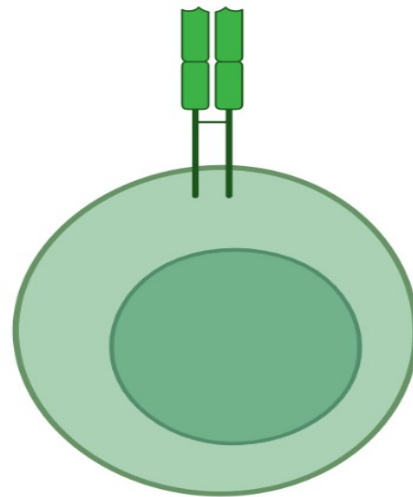
EPITOPE



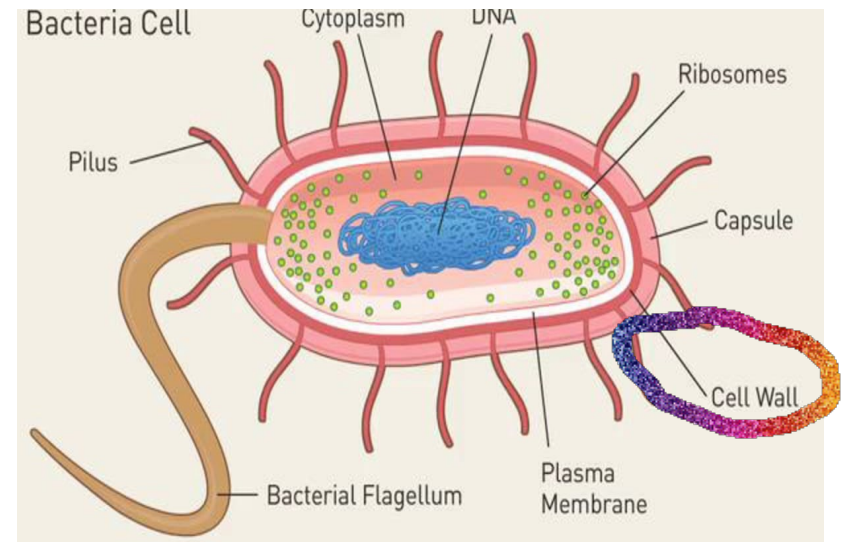
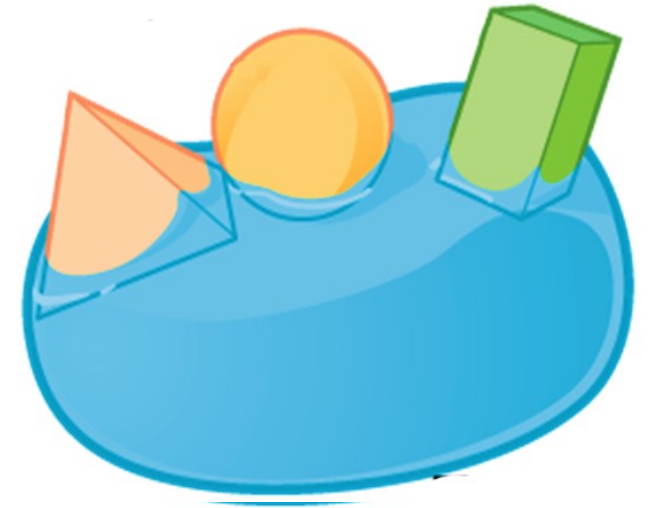
Clone 3



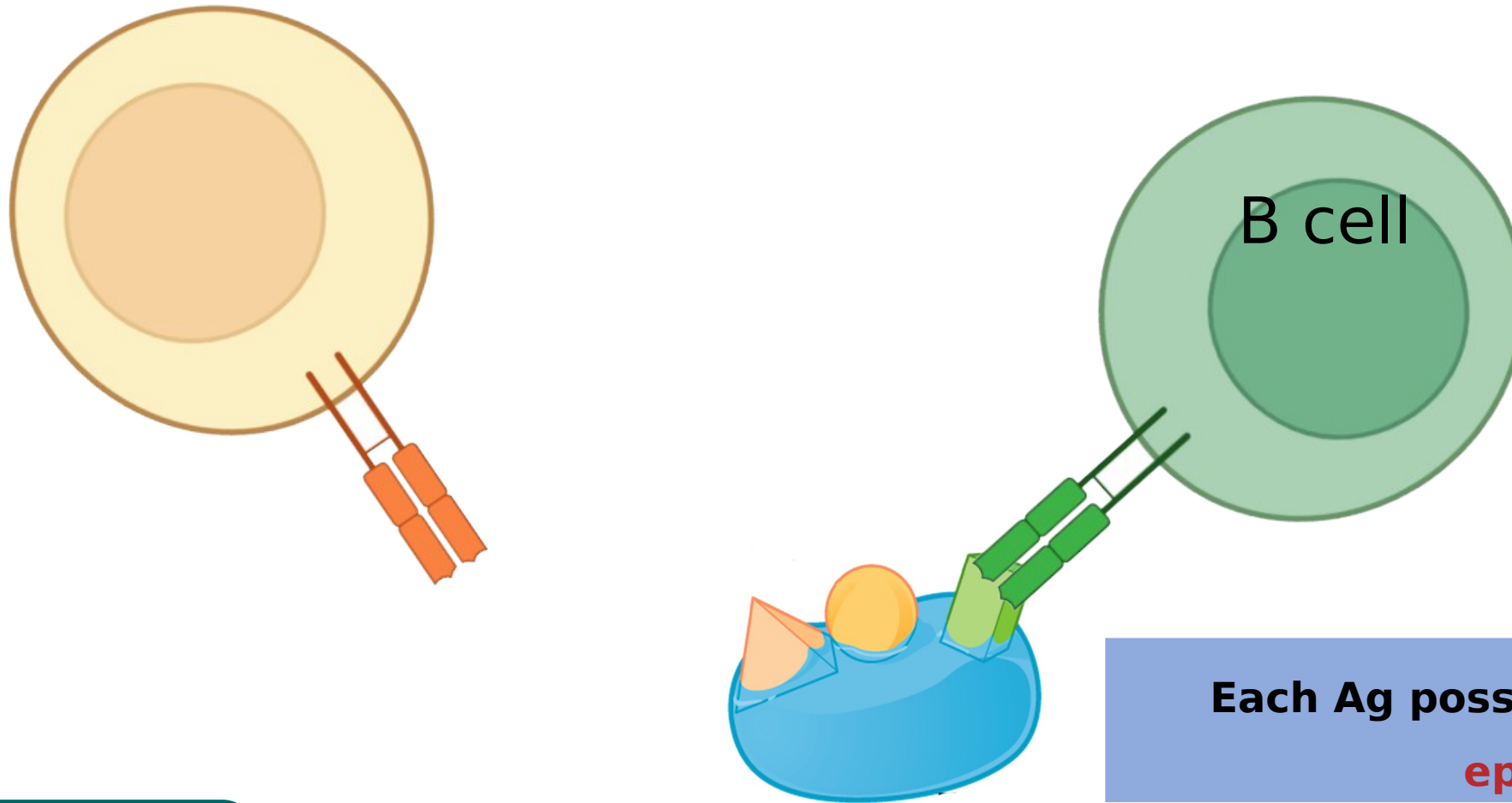
Clone 2



Clone 1



EPITOPE



Each Ag possesses **different epitopes**

Definition

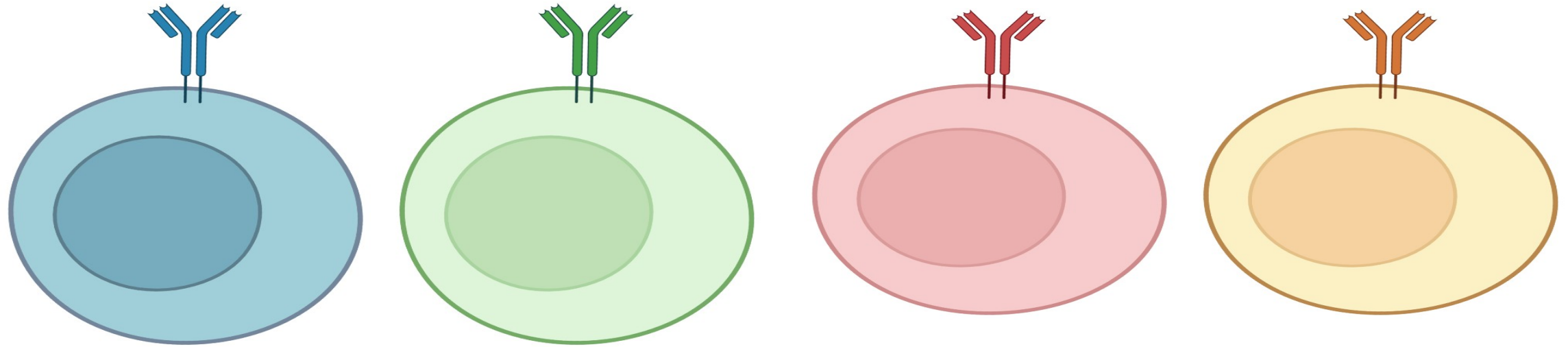
The **smallest biochemical unit** of Antigen that binds specifically **with Ag receptor** on B & T lymphocytes

↓
Stimulation of immune response

اصغر وحدة
كيميائية

تحفيز الاستجابة

4 different clones



Importanc

► Each lymphocyte clone has a unique receptor that is **مستقبل متفرد**

a) **Specific** for one epitope

b) **Different** from receptors of all other clones

**مختلف عن مستقبلات
النسائل الأخرى**

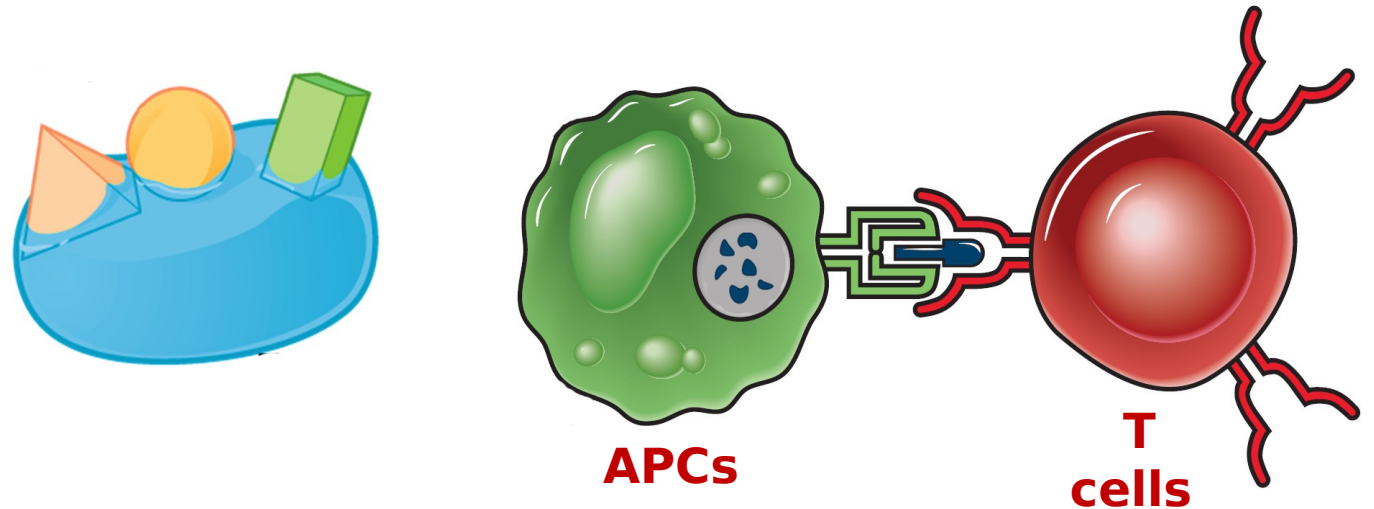
► T & B lymphocyte receptors recognize only **epitopes**

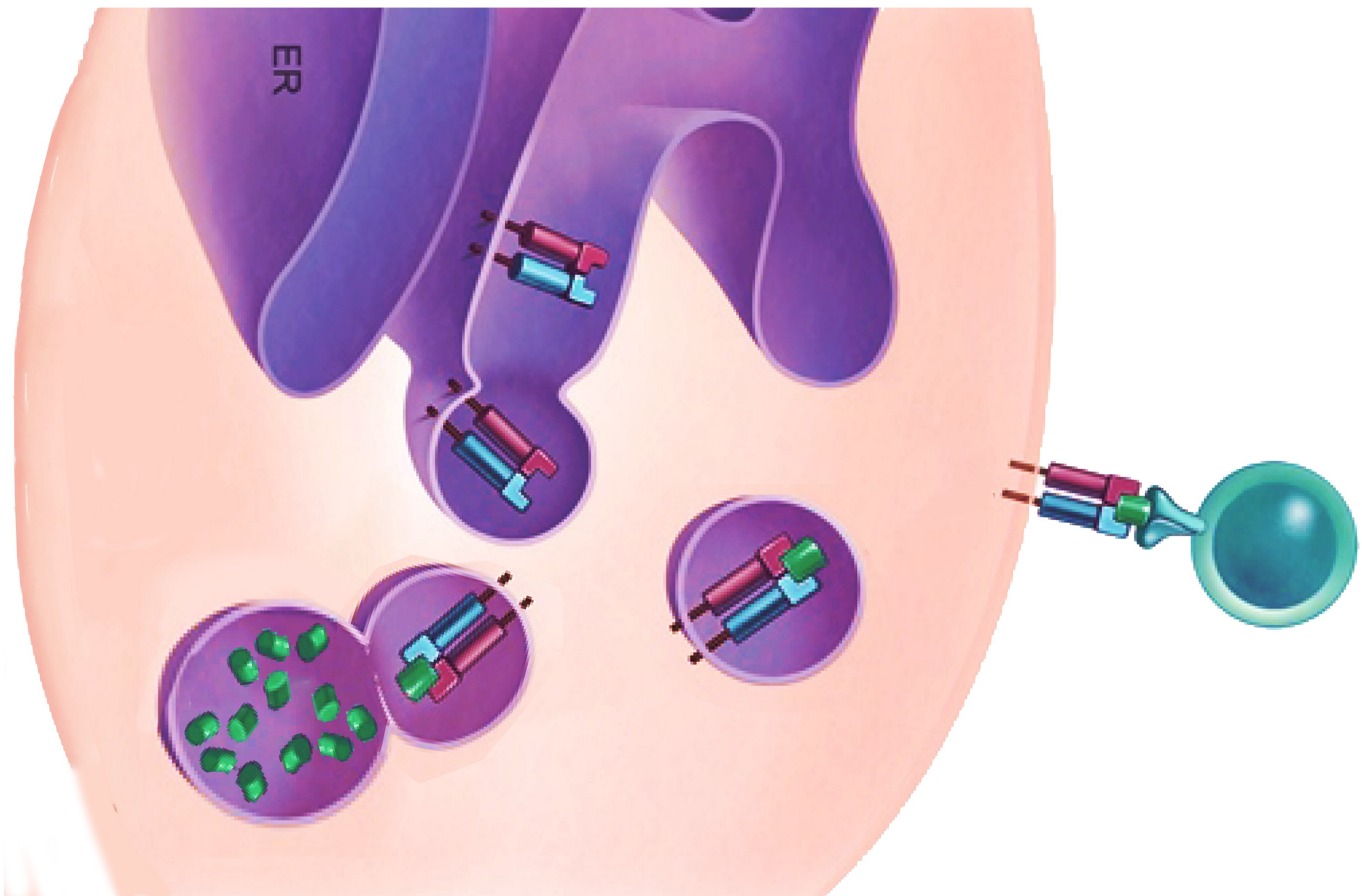
EPITOPE

Outcome of
phagocytosis

Dendritic cells & Macrophages

Present Ag to T cells
(Ag presenting cells APCs)



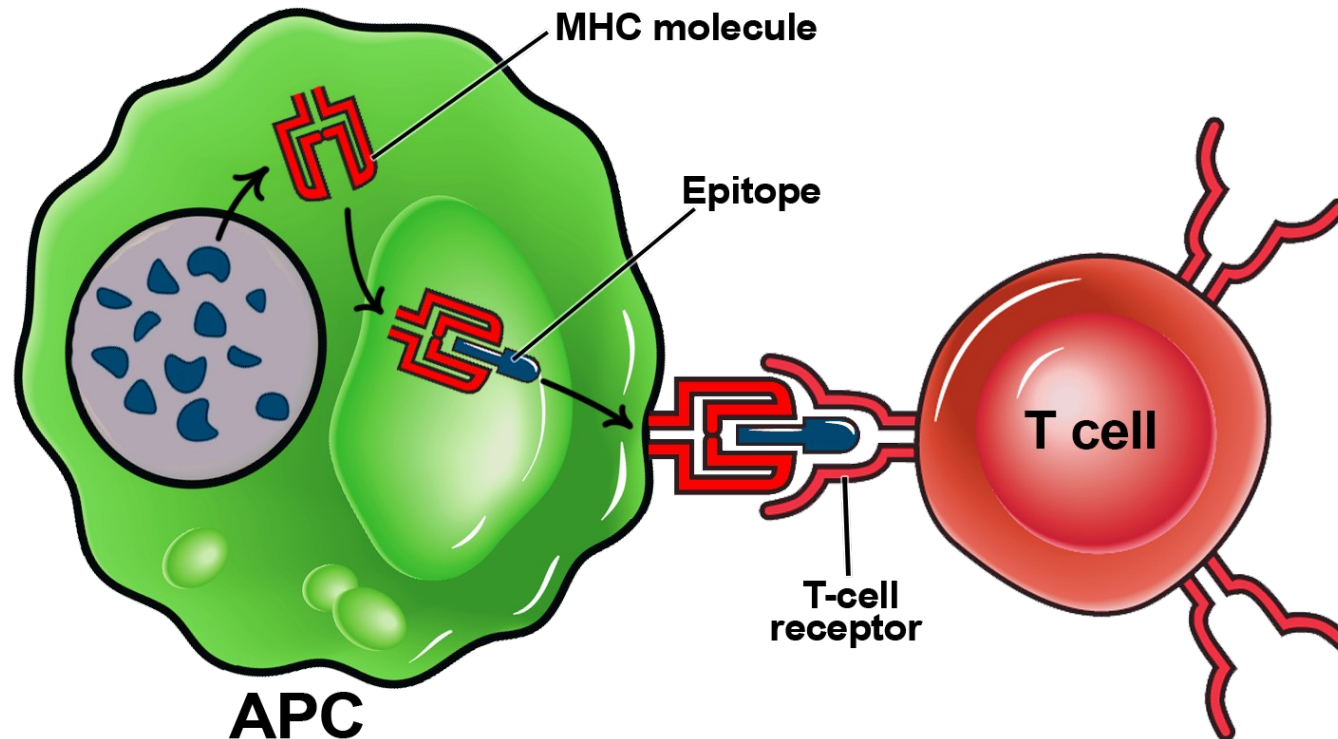


EPITOPE

Importanc

► T lymphocyte receptor (TCR) only recognizes:

- Processed protein Ag (epitope)
 - in MHC molecule
- } on the surface of Ag presenting cell (APC)



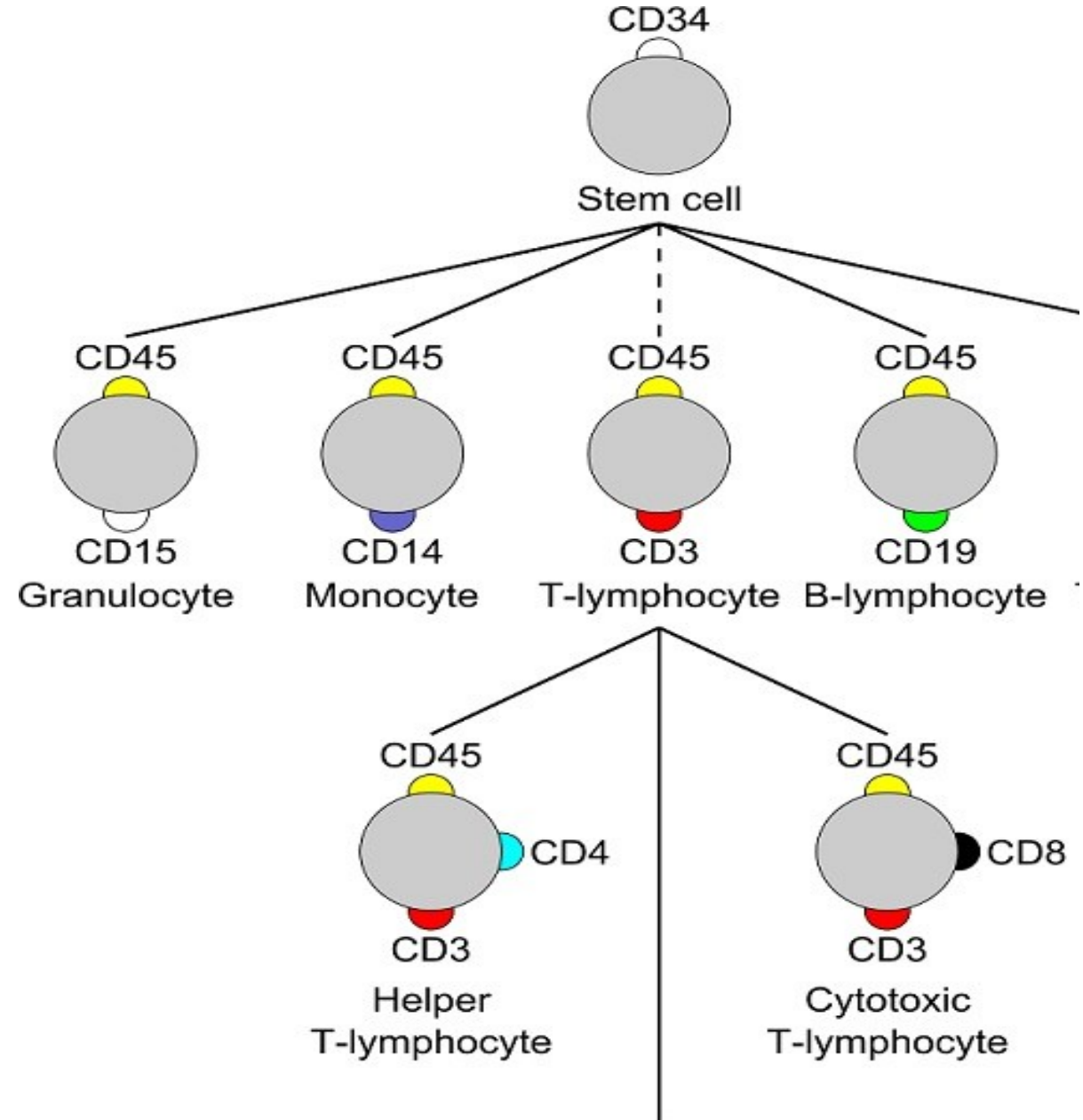
CD molecules

a) Expressed on all immune cells
& have numbers

b) Each immune cell has > 1 CD,
but one is specific e.g
خاص بها فقط

T cells :
CD3

{ Th : CD4
Tc : CD8



Major histocompatibility complex (MHC) مركب رئيسي لتوافق الانسجة OR Human leukocyte Ags (HLA)

Definitio

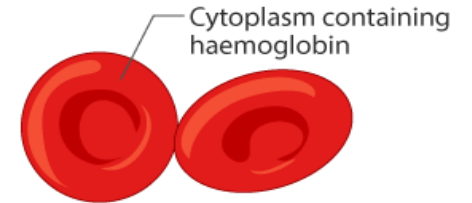
بروتينات

Self proteins

on surface of nucleated cells (absent on RBCs)

& were 1st discovered on leukocytes

المحترفين
الثلاثة



MHC class I

MHC class II

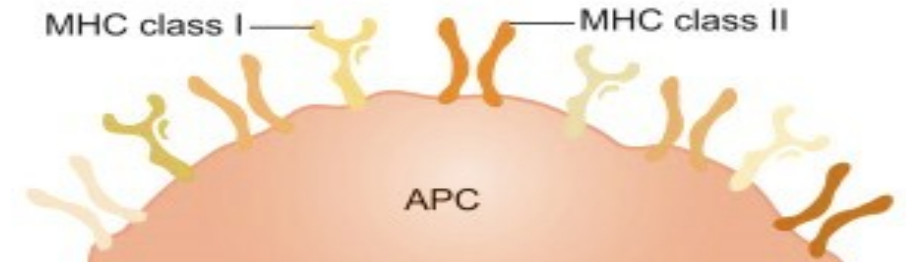
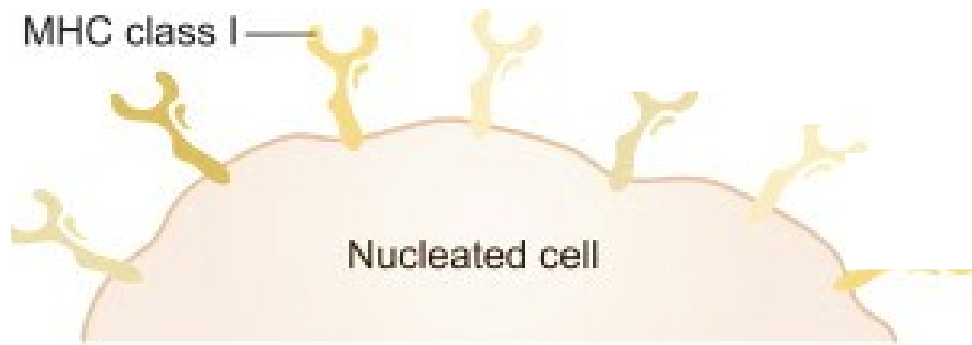
Site

All nucleated cells

(including professional APCs)

Professional APCs :

Dendritic cells, Macrophages & B cells



MHC class I

MHC class II

Structure

Each molecule (protein) is formed of 2 polypeptide chains : α & β

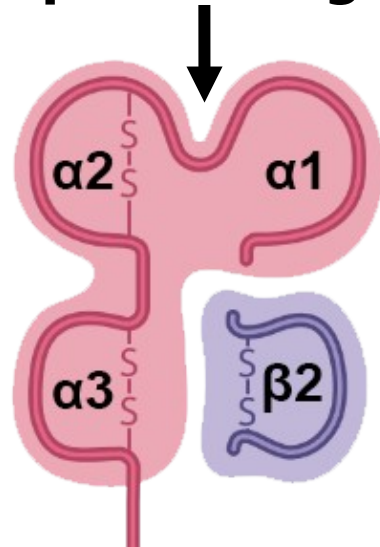
Has an Ag (epitope) binding site

Source of expressed Ag

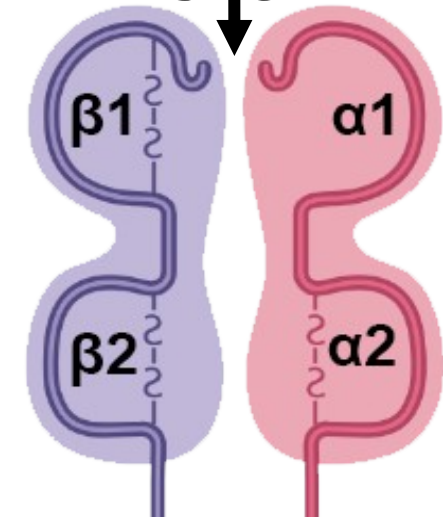
Endogenously synthesized (new)
Ags ?

Exogenously phagocytosed
Ags ?

Epitope binding site



Epitope binding site



الاهمية
الصحية
Importance
in health

MHC class I

T cells recognize Ag only in association with MHC molecules :

Tc (CD8) cells:

Recognize Ag only if associated with MHC **class I** molecule



Recognized by T cell receptor (TCR) & **CD8** molecule

MHC class II

Th (CD4) cells:

Recognize Ag only if associated with MHC **class II** molecule



Recognized by T cell receptor (TCR) & **CD4** molecule

